Testimony to Missouri State Senate
Senate Interim Committee on Utility Regulation and Infrastructure Investment

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Introduction

Thank you Mr. Chairman and members of the Committee for the opportunity to testify before you today on the important issues surrounding infrastructure investment and utility regulation. My name is Tom Tanton, and I am the Director of Science and Technology Assessment for the Energy and Environment Legal Institute or EELI. The Energy and Environment Legal Institute (E&E Legal) is a 501(c)(3) organization engaged in strategic litigation, policy research, and public education on important energy and environmental issues. E&E Legal advocates responsible resource development, sound science, respect for property rights, and a commitment to markets over government micro-management.

By way of introduction, I have over 40 years of direct and responsible experience in energy technology and legislative interface, having been central to many of the critical legislative changes that enable technology choice and economic development at the state and federal level. Until 2000, I was Principal Policy Advisor with the California Energy Commission (CEC) in Sacramento, California. I began there in 1976, developing and implementing policies and legislation on energy issues of importance to California, the U.S. and International markets. These included electric restructuring, gasoline and natural gas supply and pricing, energy facility siting and permitting, environmental issues, power plant siting, technology development, and transportation. I completed the first assessment of environmental externalities used in regulatory settings. I held primary responsibility for comparative economic analysis, environmental assessment of new technologies, and the evaluation of alternatives under state and federal environmental law. As the General Manager at EPRI, from 2000 to 2003, I was responsible for the overall management and direction of collaborative research and development programs in electric generation technologies, integrating technology, market infrastructure, and public policy. From 2003 through 2007, I was Senior Fellow and Vice President of the Houston based Institute for Energy Research.

As you consider changes to rate and other regulation in natural gas, water and electricity, keep in mind that all critical infrastructures, both those with rate regulation and those without, are increasingly interconnected and interdependent. The electricity infrastructure is dependent on and depended upon by natural gas infrastructure, while both are dependent upon and depended upon the information technology infrastructure, and transportation infrastructure, and the finance infrastructure. What you do will affect critical infrastructures beyond the particular industry of focus and will impact your overall economy and quality of life for all Missourians.

Your focus should include changing the charge to the regulator (Public Service Commission) in addition to easing the financial and business behavior of the regulated.

This means setting metrics of success correctly i.e. not picking technology winners and losers and ensuring appropriate social metrics. Be technology agnostic. If you want cheap, ask for cheap. If you want reliable ask for reliable. If you want 'clean' ask for clean and specify what it means. Do not assume a particular technology provides any of these things. Demand proof, you are after all the "Show me" state.

Too often analysts and policy makers place 'energy efficiency' on too high a pedestal. Energy and its efficient use is but one factor of production and not a primary one. Too often what is lost is productivity, which involves optimizing all factors of production including capital, labor and land. You should direct the PSC to focus on overall economic productivity of labor and capital (and land) and ignore the siren call for energy efficiency or, worse, 'jobs created.'

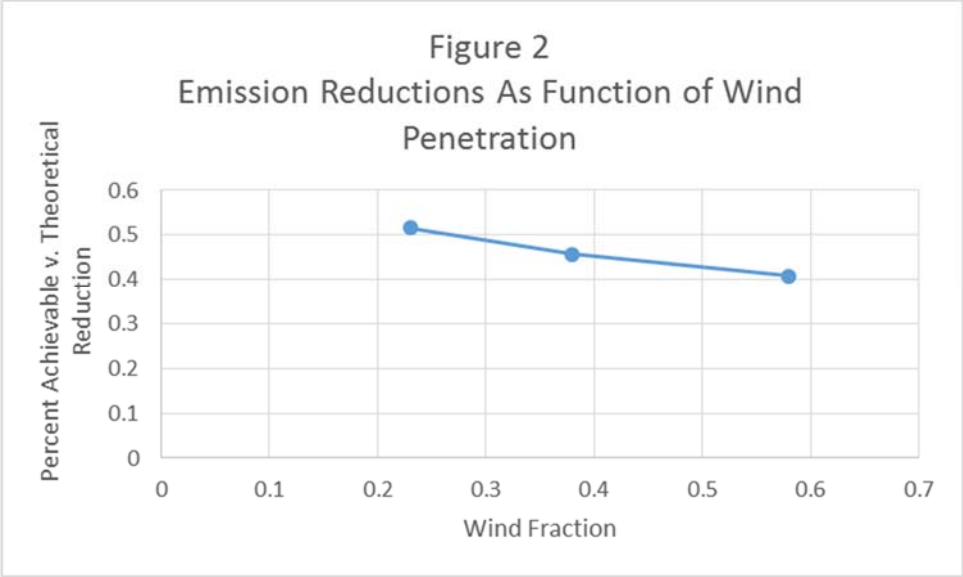
The commodity of electricity is changing and along with it, regulation should change. Electricity is less and less a 'bulk' commodity and is increasingly, from the consumers' perspective, a value added digital-enabling differentiated service. Rate regulation needs to shift from a cost of service basis to a value of service basis. Under the historical regulatory compact, utilities were granted exclusive access to a geographic area, in exchange for the obligation to serve those within the area and based on rates determined as the reasonable cost to serve. Today, some argue that elements of the rates should be priced based on their value to the customer, which often is different than the cost to the provider. But a mixed market, partially based on regulatorily determined costs and partially based on value, is likely to result in mixed market signals—even though it would be preferable to a faux market established by fiat. Reliability has different levels and different values depending upon the end use. Further, various quality metrics such as tighter voltage control and harmonics play an increasing role in consumer satisfaction and perceived value. Regulations should not only enable this but should encourage enhanced customer value decision points by differentiated end-uses. Pricing options will need to expanded along with 'quality' options, much like gasoline choices at the pump.

Building infrastructure takes time and careful management, just as does reforming rate regulation. Building in contingencies and 'auto response' avoids the need to re-legislate response to unintended results. The electricity crisis in California in 2000 was due in large measure to a wholesale bidding protocol that only works in supply surplus conditions and not, as we experienced, a supply shortfall; had there been in place a fall back bidding protocol we'd have saved perhaps $20Billion. At the same time a bit of grit can avoid overreaction; very short term rate disruptions caused the whole approach to blow up and we ended up in a worse than we started. But California NEVER actually "deregulated" nor an energy crisis, it was a capacity crisis, initiated in the natural gas infrastructure. It has been unfairly used to denigrate the concept of 'deregulation.'

Do not let your PSC rely exclusively on so-called Benefit/Cost analysis to justify rate treatments. The non-linearity of costs and benefits or the fallacy of composition make questionable such analysis. For example, net metering may be 'good' in small doses, but can become problematic in high concentrations; the problem is in setting rate components to get the 'right' amount considering short and long term reliability. This requires analysis of distributional impacts in a way than allocates costs and benefits in an equitable (to participants and non-participants) fashion. Do not rely on estimates of aggregated benefits and costs. Fairness and equity, key to good public policy, requires

consideration of the distribution of benefits and costs, along with finding less expensive options.

The intermittent nature of some power sources especially wind and solar photovoltaic means that it is necessary always to have available other power sources capable of supplying *and balancing* the total peak load of electricity. Moreover, to avoid disruption in supply, these sources must be readily available, which means effectively that they are constantly spinning and consuming fuel. When solar output increases, generation companies curtail generation from other sources, known as "intermediate load units," sufficient to accommodate the solar power. When the solar output drops, generation from the intermediate load units is increased or otherwise brought back on line as needed. The process by which generation is ramped up and down at a plant due to wind or any other factor is called "cycling." Integrating erratic and unpredictable renewable resources with established coal and natural gas generation resources requires the electricity generators to cycle their intermediate load coal and natural gas-fired units. This cycling results in significantly less efficient performance of EGUs powered by fossil fuels.[i] The net result is increased emissions and fuel use, with attendant costs. These costs are seldom included in analyses of net metering. These costs increase, per kWh, at a rate faster than the growth in renewable generation. The curve of emission reductions per kWh versus wind penetration is downward sloping. While every grid is different and has different slopes and intercepts, Figure 2 illustrates this phenomenon using the Irish Grid.[ii] The vertical axis shows the percent reduction achieved compared to "perfect" subsitution with full avoidance of fossil fuel for each KWh of wind. While differeing in magnitude, the phenomennon holds for solar, but there is inadequate data to illiustrate it given solar's rapid and recent growth.



Source: ESB National Grid, 2004

Using benefit/cost analysis as the "be-all" is short sighted and often leads to poor policy. While necessary, it is insufficient. Use of benefit/cost alone ignores the equally

important question of whether the benefits can be achieved at less cost. Are other techniques available that reduce carbon emissions, improve reliability, lower pollution levels at overall cost less than net metering? The answer is yes in each case.

The Midcontinent Independent System Operator (MISO) has analyzed various options to reduce carbon emissions in response to the Administration's proposed "Clean Power Plan." They compared the cost per ton of carbon reduced for a variety of generation and energy efficiency measures. They did not address NEM directly, but the results are still illustrative. The comparison of costs is shown in the figure, and

Reference case & Phase 1 scenarios

Scenario	EPA Assumptions and Methodology	Cost per ton of CO_2 reduction ($/ton) *
Reference Case	MISO's MTEP-15 Business As Usual future assumptions**	-
Building Block 1	In 2020, apply a 6% heat rate improvement to all the coal-fired units at a capital cost of $100/kW (amortized over 10 years).	5
Building Block 2	Calculate and enforce, starting in 2020, a minimum fuel burn for existing CC units to yield an annual 70% capacity factor.	53
Building Block 3	Calculate and add the equivalent amount of wind MWs to meet the incremental regional non-hydro renewable target.	237 Present value calculation for costs is the driver for the higher cost.
Building Block 4	Calculate the amount of energy savings for the MISO footprint and incorporate it as a 20-year EE program in the model.	70
All Building Blocks	Application of all building blocks.	60
CO_2 Constraint	Application of a mass-based CO_2 reduction target, allowing the model to optimize.	38

* The cost per ton of CO_2 reduction is indicative – actual values may vary depending on different input assumptions, etc.
** Assumptions matrix is available at https://www.misoenergy.org/Events/Pages/PAC20140820.aspx

illustrate that carbon can be reduced much more cheaply with easy operational changes like improving power plant heat rates or increased use of natural gas combined cycle than with most renewable technologies.[iii] The benefit of reducing carbon dioxide, and by extension NEM benefits, can most likely be achieved without resorting to the most expensive form of electricity generation, which at least for the time being is residential solar.

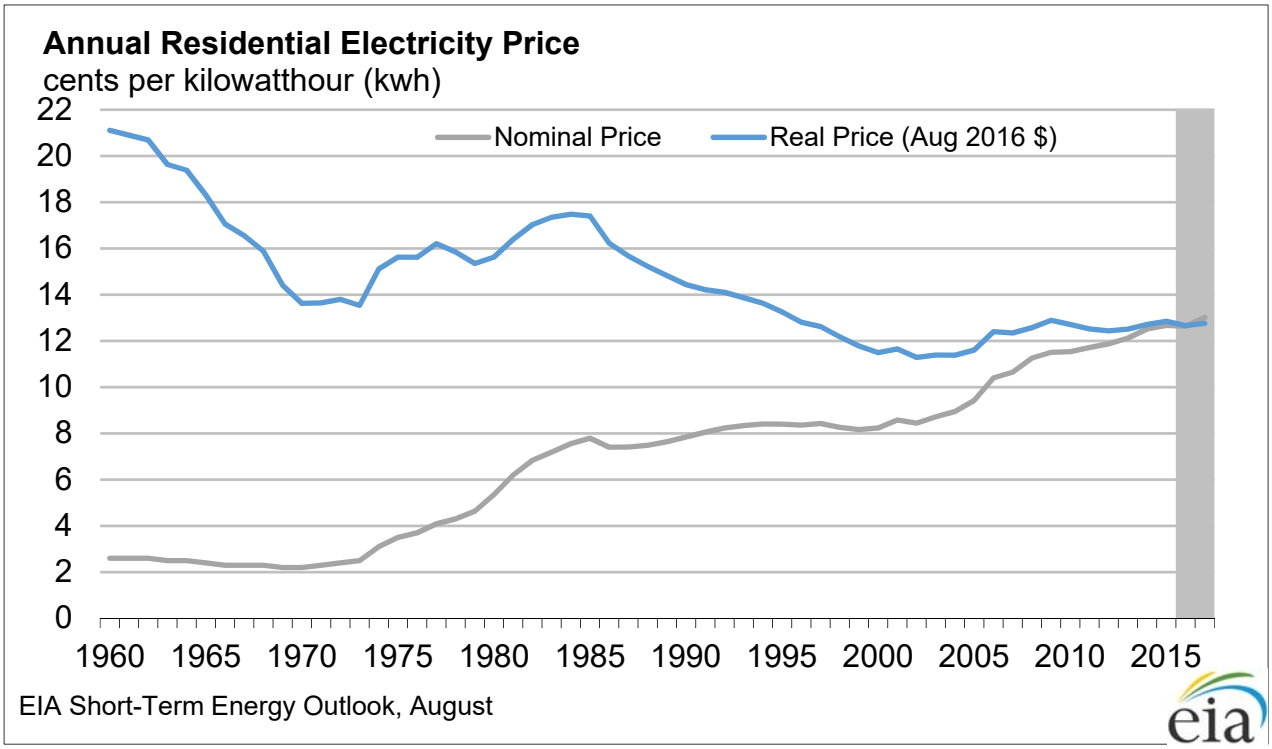
As a general principle, consumers should pay for what they get and get what they pay for. Reduce/eliminate cross subsidies or at the very least make them more transparent and explicit. This is nowhere more true than in the area of net metering. The electric power sector is a critical infrastructure for the American economy. Electrification has been called one of the greatest engineering achievements of the 20th century. Unlike most other industries, technological advances are unbundling production and delivery operations, rather than leading to vertical integration. Retail electric utilities remain regulated monopolies in every state. Retail electricity rates are not set by open markets, but result from ratemaking proceedings overseen by state regulators (e.g., public utility commissions (PUCs)) or local authorities.

In many jurisdictions, laws or regulations require distribution utilities that sell retail electric power to customers to compensate customers for the power they generate, typically from solar PV panels. Compensation can take the form of a reduction in a customer's bill if the customer consumes more electricity than he or she generates, or a payment from the utility if the customer generates more than he or she consumes. This

creates a cross subsidy from non-net metering consumers to the net metering consumers, and is typically and highly regressive.

This raises the question of who the regulator should regulate. With net metering as an option for consumers, somebody (and I suggest it's your PSC) should be regulating the alternative-to-electric utility. Many advertising and sales pitches for solar net metering installations claim continued and consistent price increases for residential electricity. In reality, real prices for residential electricity have been remarkably stable, and have actually decreased since 1960, according to the Energy Information Administration (EIA)[iv]. The following chart from EIA shows that, in constant dollars, residential electricity has dropped from over 21 to under 13 cents per kilowatt hour, and there is plenty of reason to believe that trend will hold. Most observers expect future residential price increases to result primarily from proposed policies, like EPA's so called Clean Power Plan, that favor one technology over others, or effectively ban certain fuels like coal, not from market driven changes and similar policies, like renewable portfolio standards, at the state level.

Solar sales pitches that rely on 'ever increasing electric utility cost' and similar deceptions, and eliminating inherent cross subsidies should be a focus of your PSC.



Finally, there is a blurring of the demarcation between wholesale and retail markets, which causes complexity in state versus federal regulation. This is perhaps most evident in states' renewable portfolio standards, fundamentally a retail consideration. Renewable requirements in the various states impose costs in other states by virtue of grid balancing in what is most often a multi-state grid. This raises the issue of Federalism and the extent of states' rights. I have no specific recommendation for your

Legislature to provide guidance to your PSC other than to stay alert to possible encroachments on your own state sovereignty.

Thank you and I'm available for questions.

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[i] Bentek Energy (2010), "How Less Became More: Wind, Power and Unintended Consequences in the Colorado Energy Market," http://www.wind-watch.org/documents/wp-content/uploads/BENTEK-How-Less-Became-More.pdf

[ii] ESB National Grid, Impact of Wind Power Generation In Ireland on the Operation of Conventional Plant and the Economic Implications ESB National Grid, Dublin, 2004.

[iii] https://www.misoenergy.org/Library/Repository/Meeting%20Material/Stakeholder/PAC/2014/20140917/20140917%20PAC%20Item%2002%20GHG%20Regulation%20Impact%20Analysis%20-%20Study%20Results.pdf

[iv] http://www.eia.gov/forecasts/steo/realprices/